MECHANICS.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

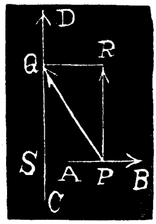
SOLUTIONS OF PROBLEMS.

28. Proposed by O. W. ANTHONY, Professor of Mathematics, New Windsor College, New Windsor, Maryland.

A movable finite wire carrying a current of electricity is perpendicular to and on one side of an infinite wire also carrying a current. Investigate the motion of the movable wire.

Solution by the PROPOSER.

Let AB be the finite wire, and DC the infinite wire. Let the current flow away from the infinite wire in the short one. Also call μ_1, μ_2 the current strengths of the two currents, and m the power of the finite wire. Then $df_{PQ}=\mu_1\mu_2\frac{dxdz}{x^2+z^2}$, $x=QS$, $z=PS$. Resolving forces perpendicular and parallel to DC we have



$$df_{PR}=\mu_1\mu_2\frac{xdxdz}{(x^2+z^2)^{\frac{3}{2}}}.$$

$$\therefore f_{PR}=2\mu_1\mu_2\int_{z_1}^{z_2}\int_0^{\infty}\frac{xdxdz}{(x^2+z^2)^{\frac{3}{2}}}.$$

$$=2\mu_1\mu_2\log\left(\frac{z_2}{z_1}\right).$$

$$\therefore \frac{d^2s}{dt^2}=\frac{2}{m}\mu_1\mu_2\log\left(\frac{z_2}{z_1}\right).$$

$$s=\frac{1}{m}\mu_1\mu_2\log\left(\frac{z_2}{z_1}\right)t^2+k_1t+k_2.$$

29. Proposed by J. A. CALDERHEAD, A. B., Superintendent of Schools, Limaville, Ohio.

Show that if a body be projected from the angle A of a plane triangle ABC so as to strike the side CB at a point D, then, if its course after reflection at D be parallel to AB, $\tan\angle DAB=\dfrac{(1+e)\cot B}{1-e\cot^2 B}$.

Solution by ALFRED HUME, C. E., D. Sc., Professor of Mathematics in the University of Mississippi, University P. O., Mississippi.

The angle between the course of the body before impact and the side CB is $180^\circ-(B+DAB)$.

$$\therefore e=\frac{\tan B}{\tan[180^\circ-(B+DAB)]};$$

$$-\tan B = e\,\frac{\tan B+\tan A}{1-\tan B\tan A};$$

$$\tan DAB = \frac{(1+e)\tan B}{\tan^2 B - e}$$

$$= \frac{(1+e)\cot B}{1-e\cot^2 B}.$$

Also solved by *O. W. ANTHONY*, and *J. SCHEFFER*.

PROBLEMS.

35. Proposed by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Applied Science, Texarkana College, Texarkana, Arkansas-Texas.

A man weighs 150 pounds; his balloon with all its attachments weighs 500 pounds. What volume of pure hydrogen must be made and put into the balloon so that it will be on the point of ascending with the man? How many kilograms of zinc and of hydrogen sulphate will be used in generating the hydrogen? Give volume of hydrogen in cubic feet given that one litre of hydrogen weighs .0896 grams.

36. Proposed by O. W. ANTHONY, Professor of Mathematics, New Windsor College, New Windsor, Maryland.

A vertical slit is made in the middle of the side of a rectangular box containing water. What is the time required to empty the box?

AVERAGE AND PROBABILITY.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

26. Proposed by J. W. WATSON, Middlecreek, Ohio.

Find the average area of all right-angled triangles having a *constant* hypotenuse.

III. Solution by F. P. MATZ, D. Sc., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pennsylvania.

In my first two solutions I made an arm of the right-angled triangle vary uniformly, although I employed two different systems of co-ordinates. I continued this variation until the arms of the right-angled triangle became equal; and by doing this I avoided all *reciprocal* equal right-angled triangles. Looking at results from this standpoint, the verdict must be—*correct*. By simply varying